Population genomics of marine fishes: next generation prospects and challenges

Over the past few years, technological advances have facilitated giant leaps forward in our ability to generate genome-wide molecular data, offering exciting opportunities for gaining new insights into the ecology and evolution of species where genomic information is still limited. Marine fishes are valuable organisms for advancing our understanding of evolution on historical and contemporary time scales, and here we highlight areas in which research on these species is likely to be particularly important in the near future. These include possibilities for gaining insights into processes on ecological time scales, identifying genomic signatures associated with population divergence under gene flow, and determining the genetic basis of phenotypic traits. We also consider future challenges pertaining to the implementation of genome-wide coverage through next-generation sequencing and genotyping methods in marine fishes. Complications associated with fast decay of linkage disequilibrium, as expected for species with large effective population sizes, and the possibility that adaptation is associated with both soft selective sweeps and polygenic selection, leaving complex genomic signatures in natural populations, are likely to challenge future studies. However, the combination of high genome coverage and new statistical developments offers promising solutions. Thus, the next generation of studies is likely to truly facilitate the transition from population genetics to population genomics in marine fishes. This transition will advance our understanding of basic evolutionary processes and will offer new possibilities for conservation and management of valuable marine resources.
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